

APPENDIX M3

STUDY OF  
ALTERNATE DISPOSAL AREAS  
FOR  
GREEN BAY HARBOR, WISCONSIN

U. S. ARMY ENGINEER DISTRICT, CHICAGO  
CORPS OF ENGINEERS  
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DREDGING AND WATER QUALITY PROBLEMS  
IN  
THE GREAT LAKES

APPENDIX M3

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ALTERNATE DISPOSAL AREAS  
FOR  
GREEN BAY HARBOR, WISCONSIN

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## APPENDIX M3 - GREEN BAY HARBOR

### WATERBORNE COMMERCE

#### 1. WATERBORNE COMMERCE STATISTICS

The waterborne commerce for the latest year available (1966) and the average commerce for a past ten year period (1957 through 1966), broken down by principal commodities, is as follows:

<u>Principal Commodity</u>	<u>1966 Commerce (Tons)</u>	<u>1957-1966 Average Commerce (Tons)</u>
Coal	1,884,822	1,800,432
Petroleum	269,876	699,973
Building Cement	214,754	172,489
Limestone	135,508	125,204
Other	<u>159,382</u>	<u>170,413</u>
TOTAL	2,664,342	2,968,511

2. PROSPECTIVE COMMERCE

Waterborne commerce is expected to rise significantly after completion of Phase II of the channel project deepening to 26 feet below datum. During Phase I the inner seven miles of channel was deepened to 24-26 feet below datum and was completed in 1967. Phase II provides for deepening the outer 8-1/2 miles and is scheduled to start in June 1969. The City of Green Bay is proceeding with a huge marsh reclamation project along the water front that will be the site of an industrial park complex. Foreign freighters as well as domestic carriers play a predominant role in commerce. Large deeper draft vessels will be able to be used after completion of the project deepening with the trend towards cargo containerization ships for package freight.

EXISTING CORPS OF ENGINEERS PROJECT

3. DESCRIPTION

Green Bay Harbor is located at the mouth of the

Fox River at the head of Green Bay about 180 miles from Milwaukee, Wisconsin via the Sturgeon Bay Canal and about 49 miles southwest of Menominee Harbor, Michigan and Wisconsin (see Figure M3-1). The project provides as shown on Figure M3-2 , for an approach channel 26 feet deep and 500 feet wide for a distance of about 8-1/2 miles from that depth in the bay to Tail Point Light and 26 feet deep by 300 feet wide to Grassy Island; an entrance channel and river channel through the City of Green Bay 24 feet deep to a point 1,700 feet upstream of the C. & N. W. Ry. Bridge; and an upper river channel 18 feet deep to the City of De Pere with a turning basin at the upper end. The project further provides for a turning basin 24 feet deep at the mouth of the East River, a turning basin 20 feet deep just above the C. & N. W. Ry. Bridge, and an east revetment 696 feet long at Grassy Island.

#### 4. STATUS OF EXISTING PROJECT

The existing project is 49% complete. New work dredging remaining to complete the project consists of deepening the entrance channel from deep water to Tail Point Light, a distance of about 7-3/4 miles, and deepening the channel from the Chicago and North Western Railway Bridge to 1,700 feet upstream. The River and Harbor Act of 23 October 1962 provides for local cooperation to furnish

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suitable areas for initial and subsequent disposal of spoil and necessary retaining dikes, bulkheads, and embankments therefore or the cost of such retaining works if it is determined by the Chief of Engineers to be required in the general public interest. This requirement includes that portion of the project from deep water in the bay to 1,700 feet upstream of the C. & N. W. Ry. Bridge. Previous River and Harbor Acts do not require that dredge disposal areas be furnished as an item of local cooperation for the maintenance dredging of the balance of the project.

5. PERTINENT NEW WORK

Deepening of the project from Tail Point Light upstream to the railroad bridge was completed in 1967. Deepening for that portion of the project lakeward of Tail Point Light will begin in 1969.

PRESENT DREDGING PRACTICES

6. DREDGING PROCEDURES

The dredging practice has been to excavate the materials with a Government-owned dipper dredge and place the excavated material in dump scows having a capacity of 600 cubic yards.

7. WORKING SEASON

The working season is generally in the eight-

month period from April through November. Ice conditions prevent the performance of any work during the winter months.

8. PREVIOUS DREDGING QUANTITIES

During the past ten years, 1,493,419 cubic yards of Federal Maintenance dredging was performed at Green Bay Harbor and approximately on an annual basis. In the recent new work dredging, 873,686 cubic yards of material was removed.

9. TYPE OF MATERIALS

Maintenance Dredging: silt and sand in varying proportions; New Work Dredging: clay, silt and sand in varying proportions.

10. NATURE OF POLLUTION

Green Bay Harbor has been classified as polluted by the Federal Water Pollution Control Administration (FWPCA). See their reports dated 16 April 1968 and July 1968 showing results of bottom and water samples taken at various times during the recent new work deepening (Appendix A).

PRESENT DISPOSAL PRACTICE

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11. METHOD OF DISPOSAL

Until 1967 the dredged material was disposed of by towing the loaded scows to disposal areas in Green Bay where the doors on the bottom of the scows were released and the spoil settled to the bay bottom in deep water. The new work dredging completed in 1967 was performed as part of the Pilot Program. Dredging was accomplished with clamshell dredges and a hydraulic dredge. That portion of the project from the mouth of the Fox River upstream was dredged with a 7 cubic yard and a 15 cubic yard clamshell dredge with the materials placed in scows and towed to a temporary dumping basin in the bay near the mouth of the Fox River. A 22 inch hydraulic pipe line dredge then rehandled the dredged material to a nearby diked land disposal area (Site No. 5 shown on Figures M3-3 and M3-4). The channel from the mouth of the Fox River to Grassy Island was dredged with the hydraulic dredge and the material was pumped directly to the land disposal area. A total of 727,634 cubic yards of material was placed on the land disposal area. The hydraulic dredge was also used to improve and deepened the channel from Grassy Island to Tail Point Light. This latter material was used to build a diked area in the bay in the vicinity of Grassy

M3-5

Island to hold future dredged material.

12. EXISTING DISPOSAL AREA

There is no established disposal area in Green Bay for this harbor. The dredged material has been placed in varied locations in deep water areas of the bay. The disposal area used in any given year was selected on the basis of convenience.

13. COST OF DREDGING

Costs for Federal maintenance dredging in the Green Bay Harbor project with disposal of the material in Green Bay has averaged \$1.00 per cubic yard.

14. ESTIMATED FUTURE DREDGING QUANTITIES

a. The anticipated dredging quantities for the ten year period from 1969 to 1978 are as follows:

<u>CALENDAR YEAR</u>	<u>MAINTENANCE (CY)</u>	<u>NEW WORK (CY)</u>
1969	120,000	3,000,000
1970	130,000	1,400,000
1971	140,000	
1972	140,000	
1973	140,000	
1974	140,000	
1975	140,000	

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<u>CALENDAR YEAR</u>	<u>MAINTENANCE (CY)</u>	<u>NEW WORK (CY)</u>
1976	140,000	
1977	140,000	
1978	<u>140,000</u>	<u>          </u>
TOTALS	1,370,000	4,400,000

b. For the estimated 4,400,000 cubic yards of new work dredging lakeward of Tail Point Light, scheduled to start in 1969, spoil disposal areas have been selected and, therefore, no areas for this dredging are being considered in this report. Of this new work dredging approximately 1,600,000 cubic yards (polluted portion) will be deposited on either the Bay Spoil Area (Site No. 1 on Figure M3-4, or on the land disposal Site No. 5 (see Figures M3-3 and M3-4 if the City of Green Bay reimburses the Government for the additional cost of spoiling on Site No. 5. The dredgings lakeward of station 260 + 00 (approximately 3 miles lakeward of Tail Point Light) have been classified as unpolluted and are scheduled to be deposited in the deep waters of Green Bay.

c. Also, no spoil disposal area is being considered in this report for the 1969 maintenance dredging. This dredging is scheduled to be deposited on the land disposal site No. 5 (see Figures M3-3 and M3-4) which the city of Green Bay made available as an item of local cooperation.

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ALTERNATE DISPOSAL AREAS AND  
METHODS CONSIDERED

In the following paragraphs each of the alternate disposal sites considered as a suitable site for the disposal of dredged materials is described. These descriptions are based on a field reconnaissance including contacting of local public officials.

15.        Disposal Site No. 1 (see Figure M3-3)

a.    Location - This site known as Bay Spoil Area, is located in Green Bay just to the west of the entrance channel between Grassy Island and Long Tail Point. The distance from the mouth of the Fox River to the site is about 2 miles.

b.    Description - This site is a partially diked area in Green Bay with water at a depth of approximately 4 feet behind the dikes. The dike was constructed in 1967 in connection with the new work dredging described in paragraph II.

c.    Size and capacity. This area is rectangular in shape with a length, parallel to the entrance channel, of about 5,000 feet and a width of about 2,000 feet. The capacity of this site, in its present condition, is about 2,000,000 cubic yards. However, as stated in paragraph

14b, additional new work dredging might be deposited on this site. If such will be the case, then the remaining capacity of this site would be about 400,000 cubic yards. To contain the maintenance dredging of the 10 year period considered in this report (see paragraph 14a), this area would have to be expanded, to the south for a distance of approximately 1,000 feet. With this expansion the available capacity for maintenance dredging would be about 1,200,000 cubic yards.

d. Method of dredging and disposal. Dredging would best be accomplished by dipper or clamshell dredge with the dredged materials loaded into scows and transported to a dumping basin and unloaded. From this dumping basin the materials would be rehandled hydraulically into the disposal site.

e. Retaining structures required. It is assumed that no major dike construction will be required for the maintenance dredging. This assumption is based on the premise that if disposal Site No. 1 is used in connection with new work dredging in 1969 (see subparagraph c above) the closing of gaps in the existing dikes and the construction of new dikes to provide added capacity for future maintenance dredging will be accomplished in connection with the new work dredging.

f. Drainage - Weirs are required to drain the excess water back into Green Bay.

g. Owner ship and availability - This site is available for the disposal of dredged materials. Use of this site for dredging disposal had been concurred in by all interested Federal, state and local agencies prior to the start of the new work dredging of 1966.

h. Views of local interests - Local interest, have no objections to the spoiling of dredged materials at this location,

i. Ultimate use. A park is intended to be developed on this site.

j. Anticipated public reaction. Dredged materials were spoiled on this site previously without adverse public reaction. Therefore no adverse public reaction is expected as a result of spoiling the maintenance dredging at this location.

16. Disposal Site No. 2 (see Figures M3-3 and M3-4)

a. Location - This site is located at the mouth of Duck Creek which is 12,000 feet northwest of the mouth of the Fox River. The south border is a Chicago and North Western Railroad track; the west border is an existing road;

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the north boundary is the Duck Creek and the east boundary is the city limits of Green Bay.

b. Description - This area is generally low lying with scattered swampy areas. The vegetative cover consists of grass, brush and trees.

c. Size and capacity. The acreage of this site is about 270 acres and the capacity of this site with fill placed 3 feet deep is 1,300,000 cubic yards.

d. Method of dredging and disposal. Dredging would best be accomplished by dipper or clamshell dredge with the dredged materials loaded into scows and transported to a dumping basin and unloaded. This dumping basin could be the one that was used for the new work dredging in 1966 and 1967. From this dumping basin the dredged materials would be pumped hydraulically into the land disposal site.

e. Retaining structures required. Diking, approximately 5 feet high, is required along three sides of this disposal area.

f. Drainage - Weirs are required to drain the excess water from this area. Drainage would be into Duck Creek.

g. Ownership and availability - This site is owned by the city of Green Bay who has indicated that this

area would be available for spoil disposal.

h. Views of local interests - Local interests have no objections to the spoiling of dredged materials at this location.

i. Ultimate use - No ultimate use has been established for this site. However, a land - use map now being prepared for Brown County indicates that this area may become a Conservation area.

j. Anticipated public reaction - No adverse public reaction is expected as a result of spoiling dredgings on this site. This is due to the fact that the land area just east of this site dredgings were deposited in 1966 and 1967 with no adverse public reaction.

17. Disposal Site No. 3 (see Figures M3-3 and M3-5)

a. Location - This site is located near the shore of Green Bay approximately 14,000 feet south-east of the mouth of the Fox River.

b. Description - This area is generally low lying and swampy and has a heavy brush and tree cover. Abutting this site on the north-west is an area that is presently being filled with wastes from the paper mills from Green Bay.

c. Size and capacity - The acreage of this

M3-12



site is approximately 480 acres and the capacity with fill placed about 2 feet deep is 1,500,000 c.y.

d. Method of dredging and disposal - Dredging would best be accomplished by dipper or clamshell dredge and the dredged materials rehandled either hydraulically or by trucks. The cost of rehandling by either one of these two methods would approximately be the same. For hydraulic rehandling the dumping basin used for rehandling of the new work dredging in 1966 and 1967 could possibly be used from which the dredged materials could be pumped with the aid of booster pumps into the disposal site. For truck rehandling docking facilities would have to be provided where the dredged materials could be loaded into trucks for handling to the disposal area.

e. Retaining structures required - No retaining structures are required to contain the materials within this site.

f. Drainage - A culvert would be required to drain the excess water back into Green Bay.

g. Ownership and availability - This area is owned by 4 private individuals who have indicated to the city of Green Bay that this area would be available for spoil disposal. No additional costs for spoiling on this property are anticipated.

h. Views of local interests - Local interests have no objections to the spoiling of dredged materials at this location.

i. Ultimate use - No immediate use has been established for this site. However, on the Brown County land use map it shows, as long range goal, that this area will be developed for multi-family housing and general commercial buildings.

j. Anticipated public reaction - No adverse public reaction is expected as a result of spoiling dredged material on this site.

18. OTHER SITES INVESTIGATED

a. Disposal Site No. 4 - This site would be land fill site along the Fox River immediately east of the river channel and extending from about mile 4 to mile 5.5 as measured from the mouth of the Fox River. This area had been used for spoil disposal from previous dredgings until this area was filled to a depth prohibiting the opening of the bottom dumps on scows. To retain any further dredgings at this site a steel sheet pile bulkhead would be required the cost of which is estimated at over \$1,000,000. Since the city of Green Bay did not look favorably on providing this area for spoil disposal, this site

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was rejected.

b. Disposal Site No. 5. - As already stated in this report, the 1969 maintenance dredging will be spoiled on this site. After deposition of this dredging the remaining capacity of this site will be about 3,000,000 cubic yards. This site, however, will not be available for spoiling of maintenance dredging after the year 1969. The area is intended to be developed for industrial use and, therefore, the city of Green Bay wishes that only good fill be placed on this site. Due to these reasons this site was not further considered.

#### ESTIMATES OF COST

19. Alternative Disposal - Table No. 1 summarizes the estimated unit costs of dredging and disposal in each of the alternative disposal areas considered in paragraphs 15 through 17. Unit costs shown are on an annual basis and do not reflect any costs for dike construction.

TABLE No. 1  
COSTS PER CUBIC YARD

Disposal Site No.	Cost per Cubic Yard*	Method of Dredging and Rehandling
1	\$4.05	Clamshell & Hydraulic Rehandling
2	\$4.47	Clamshell & Hydraulic Rehandling

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TABLE No. 1  
COSTS PER CUBIC YARD

Disposal Site No.	Cost per Cubic Yard*	Method of Dredging and Rehandling
3	\$4.90	Clamshell & Hydraulic Rehandling

\*Based on an average annual quantity of 140,000 Cubic yards.

The above unit costs are the most economical costs for each of the disposal sites. Other methods of dredging and disposal had been considered but were rejected due to their higher costs.

20. Years alternative disposal areas could be used - The capacity of each site considered in this report is sufficient to permit spoiling of all dredged materials of the entire 10 year program.

21. Annual charges - The estimated annual charges for the considered alternative disposal areas are given in Table No. 2. Annual charges on the investment are computed by application of an interest rate of 3-1/4 per cent and amortization on the basis of this rate. It is to be noted that the annual charges are limited to dike construction as

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all of the sites would be made available to the United States without cost except for dike construction. Diking of Disposal Site No. 1 for maintenance dredging would be accomplished in connection with new work dredging as mentioned in paragraph 15e. Diking of Disposal Site No. 3 would not be necessary. Diking would be required only at Disposal Site No. 2.

TABLE No. 2  
ANNUAL CHARGES

Disposal Site No. 2

Investment cost, dike construction	\$43,000
Annual charges	
Interest on investment (3-1/4%)	1,400
Amortization, 10 years @ 3-1/4%	<u>3,700</u>
TOTAL ANNUAL CHARGES	\$ 5,100

22. Effective Unit Dredging Costs. The effective unit dredging costs for each of the alternative disposal areas are summarized in Table No. 3. The effective unit costs include the dredging and disposal costs and the cost of the required dike construction converted to the cubic yard basis. To arrive at this effective unit cost the annual charges shown in Table No. 2 were divided by the average annual dredging quantity (140,000 cubic yards) and then added to the unit costs shown in Table No. 1.

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TABLE No. 3  
EFFECTIVE UNIT DREDGING COSTS

Disposal Site No.	Unit Costs (from Table No. 1)	Annual Charges on cubic yard basis	Effective Unit costs
1	\$4.05	-----	\$4.05
2	\$4.47	\$0.04	\$4.51
3	\$4.90	-----	\$4.90

COMPARISON OF PRESENT AND  
ALTERNATIVE DISPOSAL PRACTICES

23. Cost per Cubic Yard - As indicated in Table No. 3 the unit costs of dredging and spoiling of the maintenance dredging in the alternative disposal areas varies from \$4.05 per cubic yard for disposal site No. 1 to \$4.90 per cubic yard for disposal site No. 3. This is an increase of \$3.05 to \$3.90 per cubic yard over that of spoiling in Green Bay which in the past has been averaging \$1.00 per cubic yard (see paragraph 13).

DISCUSSION

24. From Table No. 3 it is apparent that the most economical alternative disposal site for the disposal of the

M3-18

maintenance dredging is Site No. 1. The next most economical site of the three sites considered is Site No. 3. However, as stated in paragraph 15e, gaps exist in the diking at Site No. 1 which have to be reconstructed before maintenance dredging can be placed on this site. This will have to be accomplished with new work dredging scheduled to start in 1969. Also, if new work dredgings are placed on this site (in addition to the dike construction), diking should be increased to provide the necessary capacity to spoil the estimated maintenance dredging of the years 1970 through 1978.

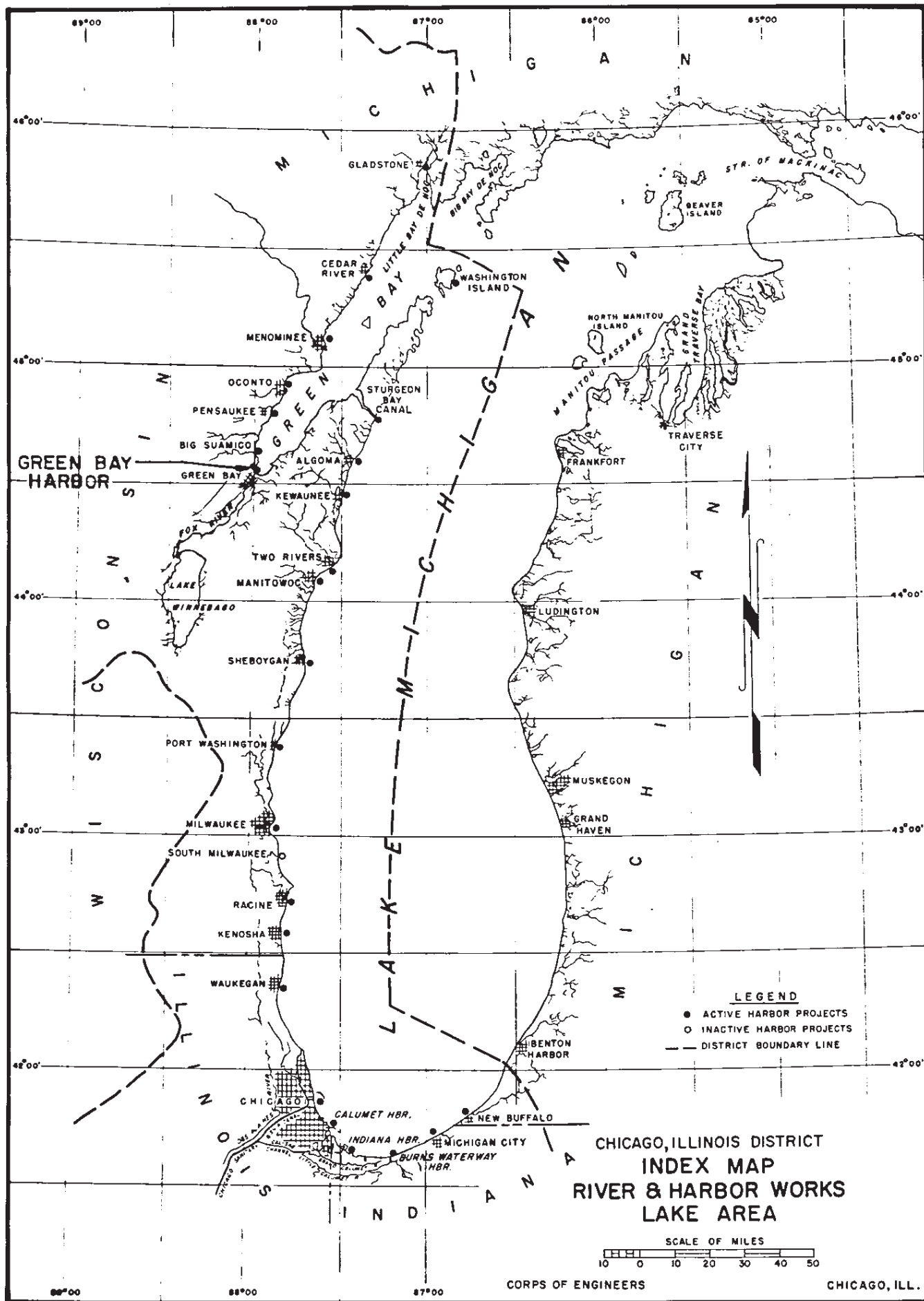


FIG. M3-1



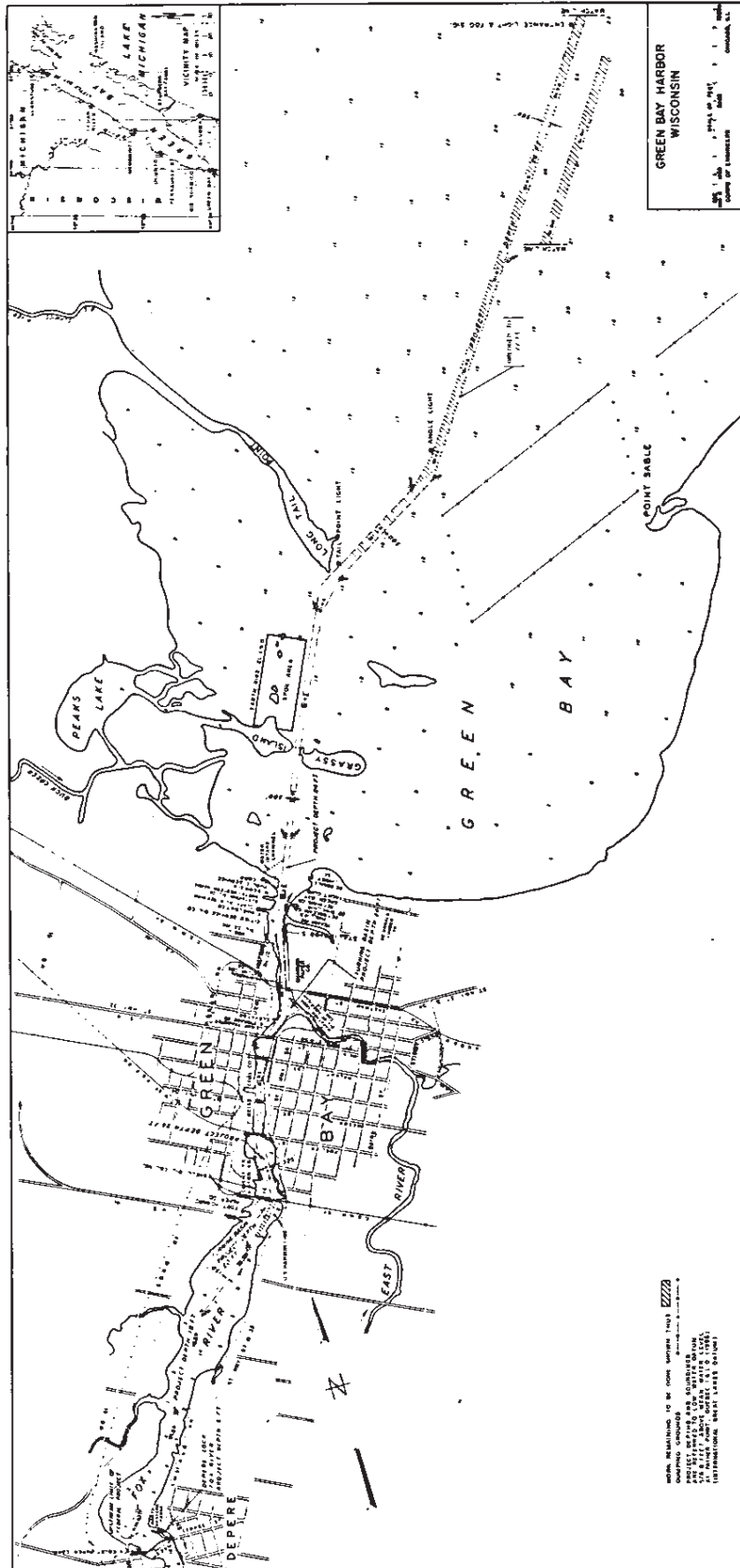


FIG. M3-2

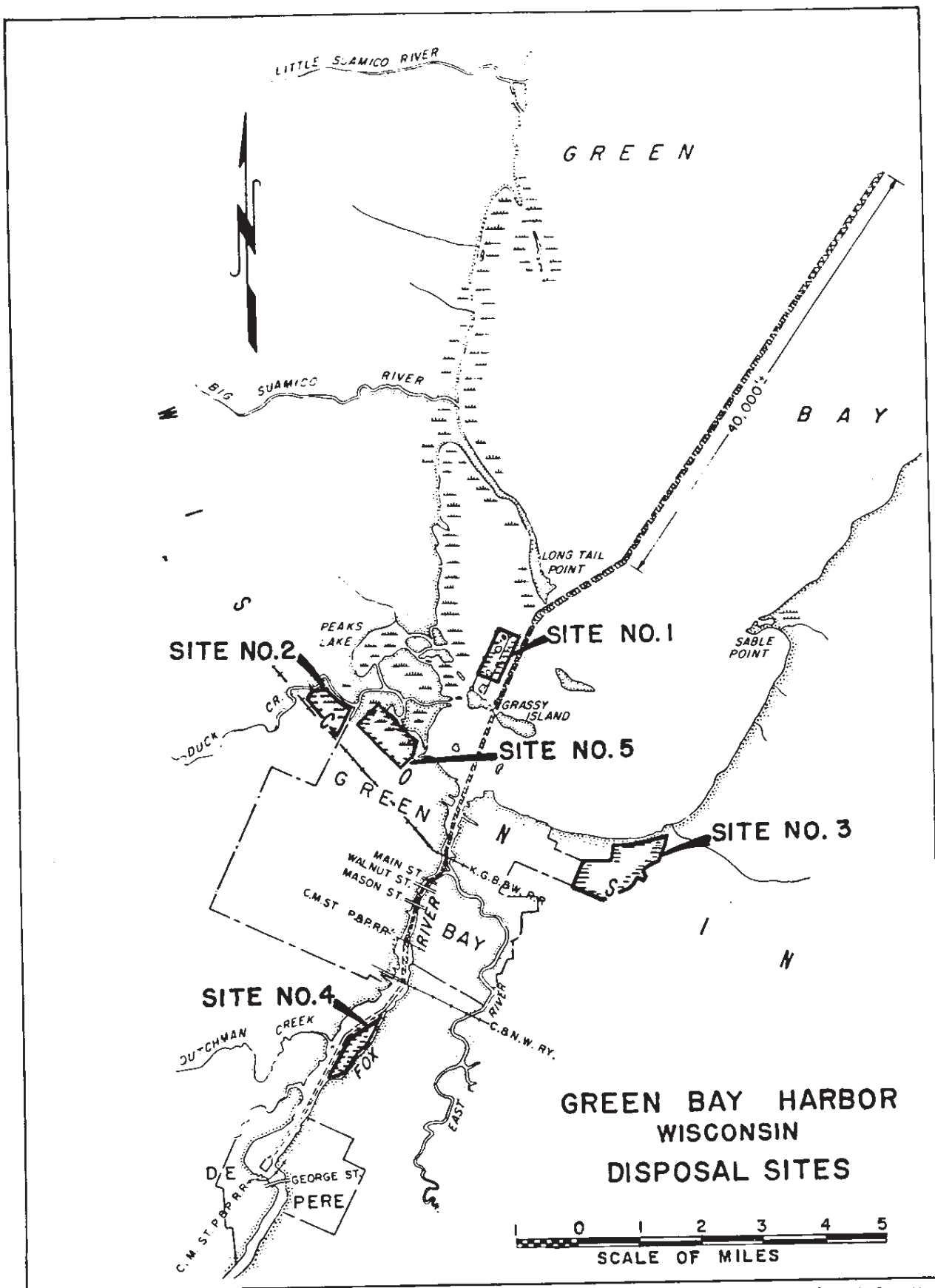


FIG. M3-3

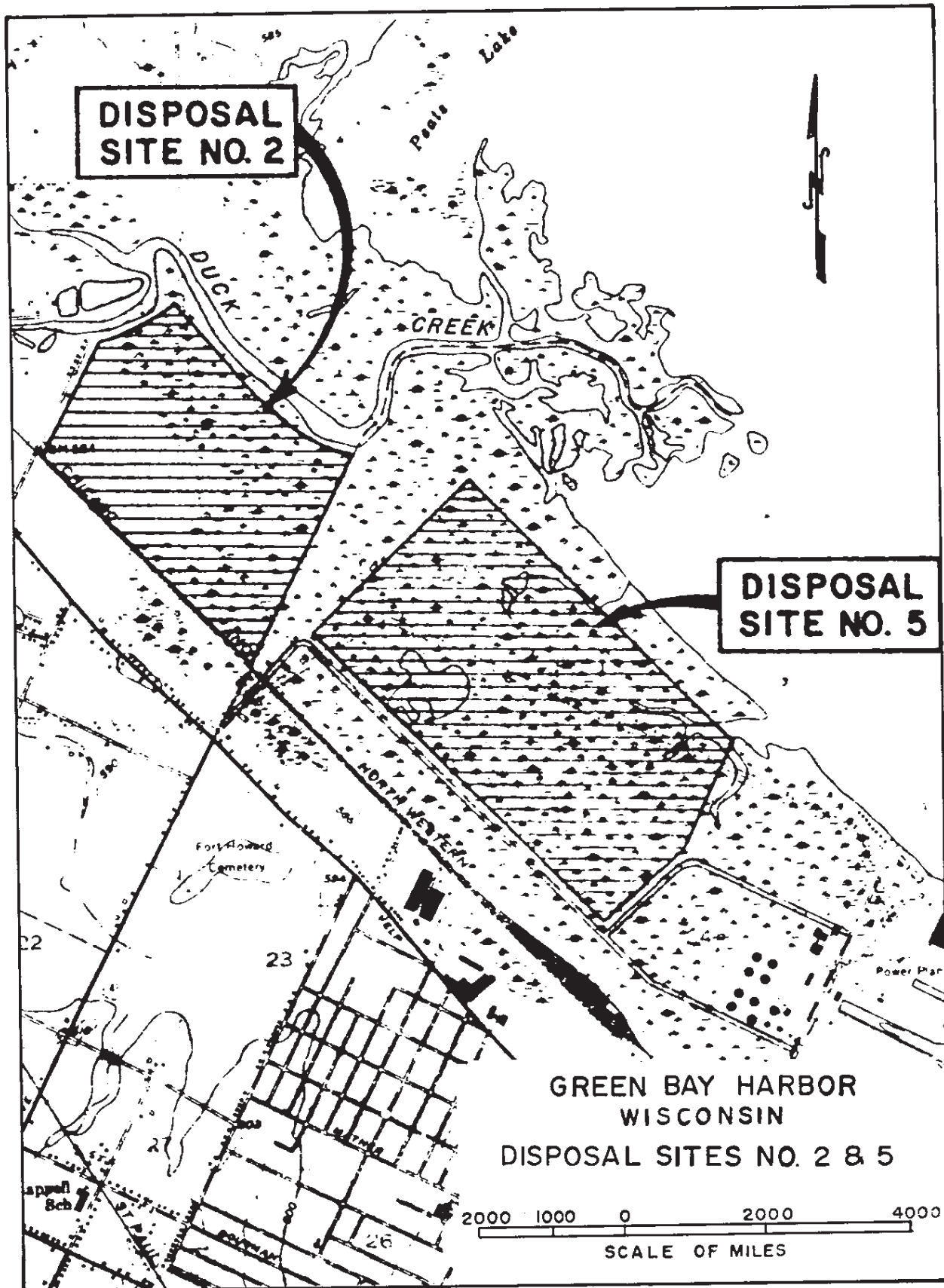


FIG. M3-4



